REMARKS

Claims 1, 3, 4, 6, 17, and 19-23 are pending. Claims 1, 3, 4, 20, 21 and 23 are amended. Claim 17 and 19 are canceled. Claims 24-26 are new. Claims 1, 3, 4, 6, and 20-26 now are pending.

Attached hereto is a marked-up version of the changes made to the specification and/or the claims by the current response. The attached page(s) is captioned "**Versions With Markings To Show Changes Made.**"

I. 37 CFR 1.83(a): DRAWINGS

The Examiner objected to the drawings and requested that the Figures show the third vertical type bipolar transistor recited in claim 17.

Since claim 17 is canceled by this Response, Applicant respectfully requests that the Examiner withdraw the objection to the drawings.

II. 35 USC 112(1): claim 17 and 21

The Examiner rejected claim 17 and claim 21 as reciting subject matter not within the application.

Claim 17 is canceled by this response. Moreover, claim 21 has been amended. Thus, Applicant respectfully requests that the Examiner withdraw the rejection to the claims.

III. 35 USC 112(2): claims 17, 21, and 23

The Examiner rejected claims 17, 21, and 23 under 35 USC 112(2), noting indefinite language.

Since Applicant has canceled or amended the claims to address the Examiner's concerns, Applicant respectfully requests that the Examiner withdraw the rejection to the claims.

IV. 35 USC 102(b)

A. Claims 1, 3, 4, 19 and 20

The Examiner rejected claims 1, 3, 4, 19 and 20 under 35 USC 102(a) as anticipated by Kumamaru (U.S. 4,379,726) or Watanabe (U.S. 4,258,379) and rejected claims 3, 4, 19 and 20 under 35 USC 102(a) as anticipated by Prior Art.

Applicant disagrees that either Kumamaru, Watanabe, or Prior Art teaches each of the limitations of the claims.

a. Kumamaru

Claim 1 recites the limitation:

a second embedded diffusion layer formed directly on the substrate

The Examiner presents substrate 1 and epitaxial layer 5 as teaching the recited substrate. Moreover, the Examiner presents epitaxial layer 5a of Kumamaru as teaching the second embedded diffusion layer. However, as seen in Figure 10 of Kumamaru, epitaxial layer 5a is formed directly on n+-type buried layer 12, not substrate 1, 5. Thus, Kumamaru does not teach this limitation.

Claim 1 recites the limitation:

a second embedded diffusion layer formed within a lower part of the epitaxial layer

The Examiner presents epitaxial layer 5a of Kumamaru as teaching the recited second embedded diffusion layer and presents epitaxial layer 11 as teaching the recited epitaxial layer. Since Kumamaru layer 11 and Kumamaru layer 5a are not distinct layers but merely represent N^--type region 13, Kumamaru layer 5a cannot be within layer 11. Accordingly, Kumamaru does not teach this limitation.

Claim 1 recites the limitation

wherein the second embedded diffusion layer is a second conductive type second embedded diffusion layer that is a different conductive type from the first conductive type substrate

This limitation is supported in the original specification at least at page 36, line 25.

Kumamaru teaches that layer 5a is an N^--type layer (See Figure 10). Since Kumamaru layer 11 and Kumamaru layer 5a are not distinct layers but merely represent N^--type region 13, Kumamaru does not teach this limitation. Since Kumamaru layer 11 and Kumamaru layer 5a are not distinct layers but merely represent N^--type region 13, Kumamaru layer 5a cannot be modified without rendering the teachings of Kumamaru inoperable.

Claim 1 recites the limitation:

wherein the second embedded diffusion layer includes an impurity concentration that is less than the impurity concentration of the first embedded diffusion layer.

The Examiner asserts that the second embedded diffusion layer 5a of Kumamaru includes an impurity concentration that is less than the impurity concentration of the first embedded diffusion layer 14 of Kumamaru. For support, the Examiner cites Kumamaru, col. 3, lines 16 and 27-28. However, Kumamaru does not teach this limitation at the lines referenced by the Examiner. Moreover, there is nothing within Kumamaru to teach the above limitation. Thus, Kumamaru does not teach this limitation.

Claim 1 recites the limitation

wherein a peak position of an impurity concentration of the first embedded diffusion layer resides at a first distance from the datum surface of the substrate and a peak position of an impurity concentration of the second embedded diffusion layer resides at a second distance from the datum surface of the substrate such that the first distance is greater than the second distance.

The Examiner asserts that since the second embedded diffusion layer 5a of Kumamaru is deeper than the first embedded diffusion layer 14, the first distance is greater than the second distance. However, the recited distances refer to the location of the peak impurity concentration, not to the layer depths. Since Kumamaru does not provide a teaching regarding the distance between the peak position of an impurity concentration of the first or second embedded diffusion layer with respect to the datum surface, Kumamaru does not teach the above limitation.

Claim 3 recites the limitation:

wherein a bottom of the first embedded diffusion layer is formed at a third distance from the datum surface of the substrate, and wherein a midpoint of the second embedded diffusion layer is formed at a fourth distance from the datum surface of the substrate such that the fourth distance is greater than the third distance.

The Examiner presents epitaxial layer 5a as teaching the second embedded diffusion layer and n+-type buried layer 14 as teaching the first embedded diffusion layer. Since the midpoint of Kumamaru defined area 5a is below the bottom of Kumamaru layer 14, Kumamaru does not teach this limitation.

Claim 4 recites the limitation:

wherein the impurity concentration of the second embedded diffusion layer ... includes a second impurity concentration that is greater than the impurity concentration of that portion of the epitaxial layer formed above the second embedded diffusion layer.

The Examiner presents epitaxial layer 5a as teaching the second embedded diffusion layer. Epitaxial layer 11 of Kumamaru is above epitaxial layer 5a. Since layer 5a and layer 11 of Kumamaru are merely conceptual divisions of layer 13, layer 5a and layer 13 have the same impurity concentration. Thus, Kumamaru does not teach the above limitation.

Claim 19 is canceled.

Claim 20 recites the limitation:

a first base disposed between two first graft base layers and disposed above the first embedded diffusion layer on the epitaxial layer to define a first epitaxial thickness; and a second base disposed between two second graft base layers and disposed above the second embedded diffusion layer on the epitaxial layer to define a second epitaxial thickness, wherein the first epitaxial thickness is less than the second epitaxial thickness.

The Examiner presents epitaxial layer 5a as teaching the second embedded diffusion layer and n+-type buried layer 14 as teaching the first embedded diffusion layer. As seen in Figure 10 of Kumamaru, the first thickness between the Kumamaru first base (unlabeled area between element 22 and 21) and layer 14 is greater than the second thickness between

Kumamaru second base 18 and layer 5a. Thus, Kumamaru does no teach this limitation.

b. Watanabe

Claim 1 recites the limitation:

a second embedded diffusion layer formed within a lower part of the epitaxial layer,

The Examiner presents buried layer 22" of Figure 8 as teaching the second embedded diffusion layer and layer 3 as teaching the epitaxial layer. Since buried layer 22" is not formed within layer 3 of Watanabe Figure 8, Watanabe does not teach this limitation.

Claim 1 recites the limitation

wherein the second embedded diffusion layer is a second conductive type second embedded diffusion layer that is a different conductive type from the first conductive type substrate

This limitation is not taught by Watanabe.

Claim 1 recites the limitation:

wherein the second embedded diffusion layer includes an impurity concentration that is less than the impurity concentration of the first embedded diffusion layer

The Examiner presents element 21(101) of Watanabe as teaching the first embedded diffusion layer and element 22" of Watanabe as teaching the second embedded diffusion layer. To teach the above limitation, the Examiner relies on the impurity concentrations shown in Figure 9 of Watanabe. However, Watanabe does not teach anything regarding the impurity concentration of first embedded diffusion layer 21(101) such as in relation to element 22". Accordingly, Watanabe does not teach the above limitation.

Claim 1 recites the limitation:

wherein a peak position of an impurity concentration of the first embedded diffusion layer resides at a first distance from the datum surface of the substrate and a peak position of an impurity concentration of the second embedded diffusion layer resides at a second distance from the datum surface of the substrate such that the first distance is greater than the second distance.

The Examiner presents element 21(101) of Watanabe as teaching the first embedded diffusion layer and element 22" of Watanabe as teaching the second embedded diffusion layer. The Examiner asserts that Watanabe teaches the above limitation but the Examiner does not provide a citation within Watanabe as to where this teaching might be.

As noted above, Watanabe does not teach anything regarding the impurity concentration of first embedded diffusion layer 21(101). Watanabe does not teach the above limitation.

The Examiner asserts that since the second embedded diffusion layer 22" of Watanabe is deeper than the first embedded diffusion layer 21(101), the first distance is greater than the second distance. However, the recited distances refer to the location of the peak impurity concentration, not to the layer depths. Since Watanabe does not provide a teaching regarding the distance between the peak position of an impurity concentration of the first or second embedded diffusion layer with respect to the datum surface, Watanabe does not teach the above limitation.

Claim 1 recites the limitation:

a second embedded diffusion layer.

The Examiner presents buried layer 22" of Figure 8 as teaching this limitation. Watanabe states that the integrated injection logic device of the Watanabe will not work if buried layer 21" (buried layer 21' with a different shape, Watanabe col. 9, lines 31-33) is used separate from well 41'. (Watanabe col. 7, lines 15-21) Since the Examiner's propose use of buried layer 21" excludes well 41', the Examiner's proposed use of buried layer 21" renders Watanabe inoperable. Thus, Watanabe does not teach the above limitation.

Claim 3 depends from claim 1.

Claim 4 recites the limitation:

wherein the impurity concentration of the second embedded diffusion layer ... includes a second impurity concentration that is greater than the impurity concentration of that portion of the epitaxial layer formed above the second embedded diffusion layer.

Watanabe does not teach the above limitation nor does the Examiner assert that Watanabe teaches the above limitation.

Claim 20 recites the limitation:

a second base disposed between two second graft base layers and disposed above the second embedded diffusion layer on the epitaxial layer

Since the base portion of Watanabe element 52 does not reside on Watanabe epitaxial layer 3, Watanabe does not teach the above limitation.

c. Prior Art

The Examiner asserts that Prior Art teaches limitations of claims 3, 4, 19, and 20. However, the Examiner has not

specified which Prior Art teaches the limitations nor has the Examiner provided Prior Art. Thus, the Examiner has not made a prima facie case of anticipation by Prior Art.

d. Conclusion

For the above reasons, Applicant respectfully requests that the Examiner withdraw the rejection to the claims.

V. 35 USC 103(a)

A. Claims 6, 21, and 23

The Examiner rejected claims 6, 21, and 23 under 35 USC 103(a) as unpatentable over Kumamaru (U.S. 4,379,726) or Watanabe (U.S. 4,258,379) as applied to claims 1, 3, 4, and 19-20 in view one of design choice and no other reference.

Applicant disagrees that the combination of Kumamaru or Watanabe and one of design choice and no other reference teaches each of the claimed limitations.

Claim 6 depends from claim 1.

Claim 21 recites the limitation:

wherein the impurity concentration of the second embedded diffusion layer is approximately equal to or higher than the epitaxial impurity concentration at all distances greater than the second distance.

Neither Kumamaru nor Watanabe teach this limitation.

To teach this limitation, the Examiner asserts that "beyond" the peak position includes that area residing between peak position 700 and the datum surface. However, in the context of the limitations, the term distances from the datum surface beyond the peak position defines that area residing on the far side of peak position 700 from the perspective of the datum surface.

Claim 1 recites that the peak position of the impurity concentration of the second embedded diffusion layer resides at a second distance from the datum surface. Thus, the term distances from the datum surface beyond the peak position can only mean distances from the datum surface farther away than the peak position distance from the datum surface. By taking the term "beyond" out of context, the Examiner concludes that "beyond" may include the space between the datum surface and the peak position 700; that is on the side of the peak that is near the datum surface.

The Examiner's position is wrong. However, to move this prosecution along, Applicant has amended claim 21.

Claim 23 recites the limitation:

wherein the first embedded diffusion layer includes an impurity concentration that is higher than an epitaxial impurity concentration of the epitaxial layer

The Examiner does not assert that either reference teaches the above limitation. Moreover, the cited combination does not teach the above limitation.

For the above reasons, Applicant respectfully requests that the Examiner withdraw the rejection to the claim.

B. Claim 17

The Examiner rejected claim 17 under 35 USC 103(a).

Claim 17 has been canceled.

For the above reasons, Applicant respectfully requests that the Examiner withdraw the rejection to the claim.

C. Claim 22

The Examiner rejected claims 22 under 35 USC 103(a) as unpatentable over Kumamaru (U.S. 4,379,726) or Watanabe (U.S. 4,258,379) in view Admitted Prior Art.

Claim 22 depends on claim 1.

VI. New claims 24-26

Claim 24 recites the limitation

wherein the second vertical type bipolar transistor includes a base layer disposed between two graph layers and wherein the epitaxial layer is disposed between the base layer and the second embedded diffusion layer

This is not by the cited art.

Claim 25 recites the limitation

wherein the substrate is a P-type substrate and wherein the second embedded diffusion layer is an N^+-type second embedded diffusion layer

This limitation is not taught by the cited art.

Claim 26 recites the limitation

wherein the substrate is a N-type substrate and wherein the second embedded diffusion layer is an P-type second embedded diffusion layer.

This limitation is not taught by the cited art.

VII. Conclusion

In view of the foregoing, it is believed that the claims now pending are in condition for allowance. Such action is earnestly solicited at the earliest possible date. If the Examiner believes that a conference would be of value in expediting the prosecution of this application, the Examiner is invited to telephone the undersigned counsel to arrange for such a conference.

Respectfully submitted,
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Dated: April 30, 2001

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service in an envelope addressed to: Box AF Amendment, Assistant Commissioner for Patents, Washington, D.C. 20231 on April 30, 2001.

_____ 04.30.01
Rose M. Garza Date: April 30, 2001

VIII. Versions With Markings To Show Changes Made

IN THE CLAIMS

Marked up rewritten claim(s) per 37 CFR 1.111(C)(1)(ii):

1. (Amended Six Times) A semiconductor device, comprising:

a substrate defining a datum surface, wherein the substrate is a first conductive type substrate;

an epitaxial layer formed on the substrate above the datum surface ~~and having an epitaxial impurity concentration and an epitaxial conductive type~~;

a first embedded diffusion layer formed as part of a first vertical type bipolar transistor in a first upper part of the substrate and in the epitaxial layer;

a second embedded diffusion layer formed as part of a second vertical type bipolar transistor directly on the substrate, in a second upper part of the substrate, and within a lower part of the epitaxial layer,

wherein the second embedded diffusion layer is a second conductive type second embedded diffusion layer that is a different conductive type from the substrate and includes an impurity concentration that is less than the impurity concentration of the first embedded diffusion layer, and

wherein a peak position of an impurity concentration of the first embedded diffusion layer resides at a first distance from the datum surface of the substrate and a peak position of an impurity concentration of the second embedded diffusion layer resides at a second distance from the datum surface of the substrate such that the first distance is greater than the second distance.

3. (Amended Three Times) A semiconductor device according to claim 1,

wherein a bottom of the first embedded diffusion layer is formed at a third distance from the datum surface of the substrate, and

wherein a midpoint of the second embedded diffusion layer is formed at a fourth distance from the datum surface of the substrate such that the fourth distance is ~~less~~ greater than the third distance.

4. (Amended Three Times) A semiconductor device according to claim 1, wherein the impurity concentration of the second embedded diffusion layer ~~is at least~~ includes a first impurity concentration that is equal to and includes a second impurity concentration that is greater than the impurity concentration of that portion of the epitaxial layer formed above the second embedded diffusion layer.

20. (Amended Two Times) A semiconductor device according to claim 1, further comprising:

a first base disposed between two first graph base layers and formed above the first embedded diffusion layer on the epitaxial layer to define a first epitaxial thickness; and

a second base disposed between two second graph base layers and formed above the second embedded diffusion layer on the epitaxial layer to define a second epitaxial thickness,

wherein the first epitaxial thickness is less than the second epitaxial thickness.

~~wherein the second embedded diffusion layer is an effective collector layer.~~

21. (Amended One Time) A semiconductor device according to claim 1, wherein the impurity concentration of the second embedded diffusion layer is approximately equal to or higher than ~~the~~ an epitaxial impurity concentration of the epitaxial layer at all distances greater than the second distance.

~~from the datum surface of the substrate beyond the peak position of the impurity concentration of the second embedded diffusion layer.~~

23. (Amended One Time) A semiconductor device according to claim 1, wherein the first vertical type bipolar transistor defines a voltage that is different than a voltage of the a second vertical type bipolar transistor,

wherein the substrate is a silicon substrate,

wherein the first embedded diffusion layer includes an impurity concentration that is higher than ~~the~~ an epitaxial impurity concentration of the epitaxial layer, and

wherein the second embedded diffusion layer defines a conductive type that is the same as ~~the~~ an epitaxial conductive type of the epitaxial layer.